INSTRUCTION MANUAL

3301 FREQUENCY COUNTER

Railway Communications, Inc.
9351 East 59th Street
Raytown, Missouri 64133

LIST OF EFFECTIVE PAGES

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CERTIFICATION

The RYCOM Instruments Company certifies that this instrument was thoroughly tested and inspected and found to meet its published specification when it was shipped from the factory.

WARRANTY AND ASSISTANCE

All RYCOM Instruments Products are warranted against defects in material and workmanship. This warranty applies for one year from the date of delivery, or, in the case of certain major components listed below for the specified period we will repair or replace products that prove to be defective during the warranty period. No other warranty is expressed or implied. We are not liable for consequential damages.

Exception – sealed rechargeable batteries. The above warranty applies to the equipment only. Sealed rechargeable batteries are subject to original manufacturers inspection.

Where it is necessary to return the instrument to the factory, furnish information to the nature of trouble encountered. Ship prepaid to:

RYCOM INSTRUMENTS
9351 East 59th Street
Raytown, Missouri 64133

Attention: Service Department

Serial No.

(Manual Part No. 0300000300)

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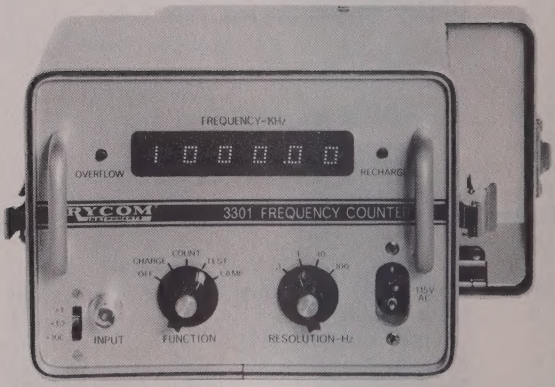


Figure 1. 3301 Frequency Counter

CHAPTER 1
GENERAL

1. SCOPE

This manual describes the Model 3301 Frequency Counter.

2. DESCRIPTION

The Frequency Counter is a completely solid state instrument designed for rugged field use. It can be an extremely useful accessory to the RYCOM Selective Voltmeters and Levelmeters that are equipped with either B.F.O. or True Restored Frequency counter output. It has a 10 Hz to 10 MHz frequency range and handles signal level from 50 millivolts to 130 volts RMS. The instrument has four manually selected gate times of .01 second, .1 second, 1.0 second, and 10 seconds. The measurement is automatically displayed in units of kilohertz.

The Frequency Counter has a 6 digit, 7 segment, LED display that automatically blanks leading zeros. The display is stored during measurements to prevent flicker.

Table 1 lists the specifications and figure 1 shows the instrument.

The instrument may be operated on either 115-volt ac or an internal battery as the power source. The battery will operate the instrument approximately 8 hours without recharging. The instrument will operate on the 115-volt ac line source with or without the battery and regardless of battery condition. A polarized three-pin male connector, on the right side of the front panel, provides access for battery charging and operation from the 115-volt ac source. The instrument may be operated while the battery is charging.

A compact metal cabinet 5 inches high, 7 inches wide and 7¼ inches deep houses the instrument. Weight, including the battery is 7 pounds. The front panel contains all the operating controls and is protected by a metal cover that snaps in place.

Table 1. Specifications

CHARACTERISTIC	SPECIFICATION
INPUT IMPEDANCE	100 K ohms shunted by 30 pF
INPUT ATTENUATION	Selectable from front panel, x1, x10, and x100
INPUT LEVEL	50 millivolts RMS through 130 volts RMS
FREQUENCY RANGE	10 Hz to 10 MHz
TIME BASE	Crystal Frequency: 1MHz Stability: Aging: $\leq$ 0.0005% Temperature: $<$ 3 parts/million, +20°C to +30°C $<$ 30 parts/million, 0°C to +50°C Gate Time: manually selected, .01 sec, .1 sec, 1.0 sec, and 10 sec.
TEMPERATURE	Operating: − 10°C to +55°C − 20°C to +75°C

Table 1. Specifications (Cont.)

CHARACTERISTIC	SPECIFICATION
POWER SUPPLY	Internal 6 volt battery. AC operation and battery charging from 115-volt AC ±10%, 50-60 Hz source.
BATTERY LIFE	8 hours without recharging
OVERALL DIMENSIONS	5 in. high x 7 in. wide x 7¼ in. deep.
WEIGHT	7 pounds

CHAPTER II
OPERATION

1. PREPARATION

The instrument has been thoroughly inspected at the factory and is covered by Warranty. However, before using the instrument, you should inspect it for shipping damage. Report any damage to the carrier and to RYCOM Instruments, Inc.

2. OPERATING CONTROLS AND INDICATORS.

Table 2 lists and describes the instrument controls and indicators.

3. PRELIMINARY CHECKS

Complete the following preliminary checks to insure that the instrument has not been damaged internally and the condition of battery charge:

NOTE

The battery has been charged at the factory and should operate the instrument without a preliminary charge cycle. However, if the instrument has been stored for an extended period of time the battery will check low and should be recharged.

To test condition of battery while it is delivering full

Table 2. Operating Controls and Indicators.

PANEL MARKING	DESCRIPTION	FUNCTION
INPUT	BNC connector	Provision for connecting Frequency Counter to external signal.
x1, x10, x100	3-position slide switch	Selects input attenuation
FUNCTION	5-position rotary switch	Selects the mode of operation.
RESOLUTION-Hz	4-position rotary switch	Selects gate time.
115 V AC	Polarized connector	Provision for connection to 115-volt AC line.
OVERFLOW	Light emitting diode	Indicates the frequency being displayed has overflowed capacity of frequency display.
RECHARGE	Light emitting diode	Indicates battery is approximately 95% discharged.

load current, set FUNCTION switch to either COUNT, TEST, or LAMP position. The RECHARGE lamp will begin to glow when battery is approximately 95% discharged.

The following procedure checks the instrument for proper functioning. Set the controls as follows:

Switch	Position
INPUT	x1
RESOLUTION-KHz	10

a. Set FUNCTION switch to COUNT. FREQUENCY-KHz display should indicate [. 0].

b. Set FUNCTION switch to TEST. FREQUENCY-KHz display should indicate [1000.00].

c. Set FUNCTION switch to LAMP. FREQUENCY-KHz display should indicate [8888.88].

4. INPUT

The INPUT connector is a BNC coaxial type. The INPUT switch, a three position slide switch just to the left of the INPUT connector provides three levels of attenuation to the input signal, the levels are x1, x 10, and x100. The Frequency Counter has its maximum sensitivity of 50 millivolts and the signal is not attenuated when the INPUT switch is in the x1 position. When the INPUT switch is in the x10 position, the incoming signal is attenuated by a factor of 10 and in the x100 position the attenuation factor is 100. The INPUT switch should be in the x10 or x100 position when noise is present on the input signal to prevent erronious readings.

Set the INPUT switch to the x10 position when the Frequency Counter is connected to a RYCOM Selective Voltmeter equipped with the True Restored Frequency counter output, this makes the Counter insensitive to low level noise that may be present at the restored frequency output. The Frequency Counter accurately represents the frequency of the signal being received by the Selective Voltmeter.

Set the INPUT switch to the x1 position when the Frequency Counter is connected to a RYCOM Selective Voltmeter equipped with the B.F.O. counter output. The Frequency Counter will indicate the frequency setting of the voltmeter dial or the tuned-to-frequency.

5. FUNCTION

The FUNCTION switch controls the mode of operation on the Frequency Counter. The OFF position disconnects the power and internal battery from the counter circuits. The CHARGE position connects the internal battery to the charging circuits. The COUNT position enables the input circuit to accept incoming signals. The TEST position connects a 1000 kHz internal signal to the input circuit and disconnects the INPUT jack from the input circuit.

The LAMP position disconnects the input circuit from the counter circuit and forces the display circuit to light all segments of the six digits. This test verifies the capability of the display circuit to display all digits properly.

6. RESOLUTION-Hz

The RESOLUTION-Hz switch controls the time base of the Frequency Counter. The frequency of the in-

coming or test signal is displayed in units of kilohertz on the FREQUENCY-KHz display. The FREQUENCY-KHz display is composed of six, seven segment numerical display, light emitting diodes. The decimal point in the display is automatically positioned by the RESOLUTION-Hz switch so that the frequency is always displayed in units of kilohertz.

Table 3 gives the display frequencies and the time rate of measurement for each switch position.

Table 3. Display Frequencies and Measurement Time Rates.

Switch Position	Display Frequency	Measurement Time Rate
.1	.1 Hz	.1 times/sec.
1	1 Hz	1 time/sec.
10	10 Hz	10 times/sec.
100	100 Hz	100 times/sec.

7. OVERFLOW

The OVERFLOW lamp is a light emitting diode. The lamp will light up when the frequency being displayed has over-flowed the six digit capacity of the FREQUENCY-KHz display. In order to display the most significant digit of a measurement that has overflowed the display, the resolution of the measurement must be reduced by rotating the RESOLUTION-Hz switch counter-clockwise to a lower resolution.

8. RECHARGE

The RECHARGE lamp is a light emitting diode and will indicate the potential condition of the internal battery. When the RECHARGE lamp starts to glow,

the battery needs to be charged. It is not necessary to interrupt measurements if the RECHARGE lamp comes on while the instrument is in use, simply connect the instrument to source of 115 volts ac using the power cord supplied. The RECHARGE lamp will then turn off and the battery will charge slowly while the instrument is being used and powered from the external 115-volt ac source. The battery will "float" when it is fully charged.

9. BATTERY

The battery will provide up to 8 hours of operation between charges. A completely discharged battery will recharge in 16 hours. Battery charging is not required when operated continuously from the ac power lines. Charging is accomplished by connecting the instrument to the ac power source and setting the FUNCTION switch to CHARGE position. The instrument can be left on CHARGE indefinitely without damage.

NOTE

The Frequency Counter should not be stored with a discharged battery.

CHAPTER III

PARTS LIST

1. HOW TO ORDER PARTS

When ordering parts, always include:

a. Name, Model and serial number of the instrument.
b. Module and reference designation.
c. Part number.
d. Description.

Order parts from:

RYCOM INSTRUMENTS
9351 East 59th Street
Raytown, Missouri 64133
Telephone 816-353-2100

NOTE: $10.00 minimum on all orders.

2. LIST OF MANUFACTURERS.

Code is listed in parts list under MFR.

Code	Name and Address
01121	Allen-Bradley Co. 1201 S. 2nd St. Milwaukee, Wisc. 53204
01295	Texas Instruments, Inc. Semiconductor-Components Div. 13500 N. Central Expressway Dallas, Tex. 75231

Code	Name and Address
03877	Transitron Electronic Corp. 168-186 Albion St. Wakefield, Mass. 01880
04713	Motorola Semiconductor Products, Inc. 5005 E. McDowell Rd. Phoenix, Ariz. 85005
05397	Union Carbide Corp., Lind Div. Kemet Dept. Cleveland, Ohio
07236	Fairchild Semiconductor, Div. of Fairchild Camera and Instrument Corp. 464 Ellis St. Mountain View, Calif. 94040
09408	StarTronics Connectors Electronic Products Div. E G and G Inc. Moulton and Monroe Sts. Georgetown, Mass. 01830
14752	Electro Cube 1710 S. Del Mar Ave. San Gabriel, Calif. 91776
16299	Corning Glass Works Electronic Components Div. 3900 Electronics Drive Raleigh N. C. 27604

Code	Name and Address
18410	RYCOM INSTRUMENTS RAILWAY COMMUNICATIONS, INC. 9351 E. 59th St. Raytown, Missouri 64133
25244	Globe-Union Inc. P.O. Box 591 Milwaukee, Wisc. 53201
29309	Richey Electronics, Inc. 1307 Dickerson Rd. Nashville, Tenn. 37213
37942	P. R. Mallory and Co., Inc. 3029 E. Washington St. Indianapolis, Ind. 46204
70903	Beldon Corp. 415 S. Kilpatrick Chicago, Ill. 60644
72136	Electro Motive Mfg. Co., Inc. South Park and John Streets Willimantic, Conn. 06226
72982	Erie Technological Products Inc. 644 W. 12th St. Erie, Pa. 16512
75042	IRC Division of TRW Inc. 401 North Broad St. Philadelphia, Pa. 19108

Code	Name and Address
76493	J. W. Miller Co. P.O. Box 5825 19070 Reyes Ave. Compton, Calif. 90024
79089	Radio Corp of America Solid State and Receiving Tube Div. 415 S. 5th St. Harrison N. J. 07029
79727	Continental-Wirt Electronics Corp. 26 W. Queen St. Philadelphia, Pa. 19144
80294	Bourns Inc. 1200 Columbia Ave. Riverside, Calif. 92507
87930	Tower Mfg. Corp. 158 Pine St. Providence, R. I. 02903
91418	Radio Materials Co. 4242 W Bryn Mawr Chicago, Ill. 60646

PARTS LIST

REF DES	DESCRIPTION	PART NO.	MFR	QTY/ ASSY
	PARTS LOCATED ON FRONT PANEL OR CHASSIS			
BT1	Battery, 6 V, 6.0 amp-hr, rechargeable	GC660-1	25244	1
C1	Cap, 0.1 uF ±10%, 200 wvdc, mylar	21OB1C104K	14752	1
C2	Cap, 2 pF ±0.5pF, 500 wvdc, silver mica	DM15C020D	72136	1
C3	Cap, 3 pF ±0.5 pF, 500 wvdc, silver mica	DM15C030D	72136	1
C4	Cap, 150 pF ±5%, 500 wvdc, silver mica	DM15E151J	72136	1
C5	Cap, 1000 uF (-10%, +100%), 15 wvdc Electrolytic	28-625-1000 -15T-85	29309	2
C6	Cap, 1000 uF, same as C5			
J1	Connector, BNC	UG657/U	09408	1
J2	Connector, electrical power	EX-585	87930	1
Q1	Transistor, germanium, PNP	2N2560	01295	1
R1	Res, 910 k ohms ±5%, ¼W, carbon	CB9145	01121	1
R2	Res, 91,000 ohms ±5%, ¼ W, carbon	CB9135	01121	1
R3	Res, 10,000 ohms ±5%, ¼ W, carbon	CB1035	01121	1

PARTS LIST

REF DES	DESCRIPTION	PART NO.	MFR	QTY/ ASSY
	PARTS LOCATED ON FRONT PANEL OR CHASSIS (Cont)			
S1	Switch, rotary	7200000920	18410	1
S2	Switch, rotary	7200001020	18410	1
S3	Switch, slide	G-128-L	79727	1
T1	Transformer, power	7000000220	18410	1
WA1	Cord Assy, power	17258S	70903	1

PARTS LIST

REF DES	DESCRIPTION	PART NO.	MFR	QTY/ ASSY
	INPUT ASSEMBLY A1			
A1	Circuit Card Assy composed of the following components, (see Figure 2 for component location).	1100001630	18410	1
A1C1	Cap, 15 pF ±5%, 500 wvdc, silver mica	DM15E150J	72136	1
A1C2	Cap, 0.01 uF ±20%, 200 wvdc, ceramic	0805030Z5U00 103M	72982	4
A1C3	Cap, 100 uF (-10%, +100%), 15 wvdc electrolytic	JA-5-100-15 -8P	29309	2
A1C4	Cap, 10 uF ±20%, 10 wvdc, tantalum	T330A106M0 104S	05397	3
A1C5	Cap, 10 uF, same as A1C4			
A1C6	Cap, 0.01 uF, same as A1C2			
A1C7	Cap, 0.01 uF, same as A1C2			
A1C8	Cap, 0.001 uF ±20%, 200 wvdc, ceramic	0831000Z5U00 102M	72982	1
A1C9	Cap, 10 uF, same as A1C4			
A1C10	Cap, 100 uF, same as A1C3			

PARTS LIST

REF DES	DESCRIPTION	PART NO.	MFR	QTY/ ASSY
	INPUT ASSEMBLY A1 (Cont)			
A1C11	Cap, 150 pF ±5%, 500 wvdc, silver mica	DM15E151J	72136	2
A1C12	Cap, 0.01 uF, same as A1C2			
A1C13	Cap, 5 pf ±.5 pF, 500 wvdc, silver mica	DM15C050D	72136	1
A1C14	Cap, 150 pF, same as A1C11			
A1CR1	Diode, silicon	1N914	01295	4
A1CR2	Diode, same as CR1			
A1CR3	Diode, same as CR1			
A1CR4	Diode, same as CR1			
A1IC1	Integrated Circuit	CA3018	79089	1
A1L1	Coil, rf, 47 uH	9250-473	76493	1
A1Q1	Transistor, FET	2N5484	04713	1
A1Q2	Transistor, silicon, NPN	2N3704	01295	2
A1Q3	Transistor, same as A1Q2			

PARTS LIST

REF DES	DESCRIPTION	PART NO.	MFR	QTY/ ASSY
	INPUT ASSEMBLY A1 (Cont)			
A1R1	Res, 33,000 ohms ±5%, 2 W, metal film	Type C-42S	16299	1
A1R2	Res, 1000 ohms ±5%, ¼W, carbon	CB1025	01121	5
A1R3	Res, 180 ohms ±5%, ¼ W, carbon	CB1815	01121	2
A1R4	Res, 22,000 ohms ±5%, ¼ W, carbon	CB2235	01121	1
A1R5	Res, 2700 ohms ±5%, ¼ W, carbon	CB2725	01121	2
A1R6	Res, 3300 ohms ±5%, ¼ W, carbon	CB3325	01121	1
A1R7	Res, 8200 ohms ±5%, ¼ W, carbon	CB8225	01121	1
A1R8	Res, 15,000 ohms ±5%, ¼ W, carbon	CB1535	01121	1
A1R9	Res, 240 ohms ±5%, ¼ W, carbon	CB2415	01121	1
A1R10	Res, 1500 ohms ±5%, ¼ W, carbon	CB1525	01121	1
A1R11	Res, 1000 ohms, same as A1R2			
A1R12	Res, 2700 ohms, same as A1R5			
A1R13	Res, 680 ohms ±5%, ¼ W, carbon	CB6815	01121	1
A1R14	Res, 1000 ohms, same as A1R2			
A1R15	Res, 33 ohms ±5%, ¼ W, carbon	CB3305	01121	1
A1R16	Res, 10,000 ohms ±5%, ¼ W, carbon	CB1035	01121	2

PARTS LIST

REF DES	DESCRIPTION	PART NO.	MFR	QTY/ ASSY
	INPUT ASSEMBLY A1 (Cont)			
A1R17	Res, 100 k ohms ±5%, ¼ W, carbon	CB1045	01121	2
A1R18	Res, 39,000 ohms ±5%, ¼ W, carbon	CB3935	01121	1
A1R19	Res, 100 k ohms, same as A1R17			
A1R20	Res, 180 ohms, same as A1R3			
A1R21	Res, 1000 ohms, same as A1R2			
A1R22	Res, 10,000 ohms, same as A1R16			
A1R23	Res, 1000 ohms, same as A1R2			

PARTS LIST

REF DES	DESCRIPTION	PART NO.	MFR	QTY/ ASSY
	COUNTER ASSEMBLY A2			
A2	Circuit Card Assy composed of the following components, (See figure 3 for component location).	1100001730	18410	1
A2C1	Cap, 0.001 uF ±20%, 200 wvdc, ceramic	0831000Z5U00 102M	72982	2
A2C2	Cap, var, 5.5-18 uF	538-006A5.5 -18	72982	1
A2C3	Cap, 22 pF ±5%, N1500-N3300, 500 wvdc ceramic	Type C	91418	1
A2C4	Cap, 500 pF ±5%, 500 wvdc, silver mica	DM15E501J	72136	3
A2C5	Cap, 500 pF, same as A2C4			
A2C6	Cap, 0.001 uF, same as A2C1			
A2C7	Cap, 0.1 uF ±20%, 100 wvdc, ceramic	8131-M100- 651-104M	72982	1
A2C8	Cap, 500 pF, same as A2C4			
A2C9	Cap, 0.01 uF ±20%, 200 wvdc, ceramic	0805030Z5U00 103M	72982	1

PARTS LIST

REF DES	DESCRIPTION	PART NO.	MFR	QTY/ ASSY
	COUNTER ASSEMBLY A2 (Cont)			
A2C10	Cap, 47 pF nominal, 500 wvdc, silver mica, used only when required.	DM15E470J	72136	1
A2CR1	Diode, germanium	1N277	03877	1
A2CR2	Diode, zener	1N746	01295	1
A2CR3	Diode, bridge rectifier	FW-100	37942	1
A2CR4	Diode, silicon	1N914	01295	6
A2CR5	Diode, same as A2CR4			
A2CR6	Diode, same as A2CR4			
A2CR7	Diode, same as A2CR4			
A2CR8	Diode, same as A2CR4			
A2CR9	Diode, same as A2CR4			
A2IC1	Integrated Circuit	SN72723L	01295	1
A2IC2	Integrated Circuit	SN7400N	01295	1
A2IC3	Integrated Circuit	SN74L00N	01295	1
A2IC4	Integrated Circuit	SN74L73N	01295	2

PARTS LIST

REF DES	DESCRIPTION	PART NO.	MFR	QTY/ ASSY
	COUNTER ASSEMBLY A2 (Cont)			
A2IC5	Integrated Circuit, same as A2IC4			
A2IC6	Integrated Circuit	SN74L90N	01295	12
A2IC7	Integrated Circuit, same as A2IC6			
A2IC8	Integrated Circuit, same as A2IC6			
A2IC9	Integrated Circuit, same as A2IC6			
A2IC10	Integrated Circuit, same as A2IC6			
A2IC11	Integrated Circuit, same as A2IC6			
A2IC12	Integrated Circuit, same as A2IC6			
A2IC13	Integrated Circuit	SN7490N	01295	1
A2IC14	Integrated Circuit, same as A2IC6			
A2IC15	Integrated Circuit, same as A2IC6			
A2IC16	Integrated Circuit, same as A2IC6			
A2IC17	Integrated Circuit, same as A2IC6			
A2IC18	Integrated Circuit, same as A2IC6			
A2IC19	Integrated Circuit	SN74L75	01295	6
A2IC20	Integrated Circuit, same as A2IC19			
A2IC21	Integrated Circuit, same as A2IC19			

PARTS LIST

REF DES	DESCRIPTION	PART NO.	MFR	QTY/ ASSY
	COUNTER ASSEMBLY A2 (Cont)			
A2IC22	Integrated Circuit, same as A2IC19			
A2IC23	Integrated Circuit, same as A2IC19			
A2IC24	Integrated Circuit, same as A2IC19			
A2IC25	Integrated Circuit	SN74L47	01295	6
A2IC26	Integrated Circuit, same as A2IC25			
A2IC27	Integrated Circuit, same as A2IC25			
A2IC28	Integrated Circuit, same as A2IC25			
A2IC29	Integrated Circuit, same as A2IC25			
A2IC30	Integrated Circuit, same as A2IC25			
A2L1	Coil, rf, 47 uH	9250-473	76493	1
A2Q1	Transistor, silicon NPN	2N3710	01295	1
A2Q2	Transistor, silicon, NPN	2N3704	01295	3
A2Q3	Transistor, silicon, PNP	2N3638	07263	2
A2Q4	Transistor, same as A2Q2			
A2Q5	Transistor, same as A2Q2			

PARTS LIST

REF DES	DESCRIPTION	PART NO.	MFR	QTY/ ASSY
	COUNTER ASSEMBLY A2 (Cont)			
A2Q6	Transistor, same as A2Q3			
A2Q7	Transistor, silicon, NPN	2N5294	79089	1
A2R1	Res, 47,000 ohms ±5%, ¼ W, carbon	CB4735	01121	1
A2R2	Res, 470 k ohms ±5%, ¼ W, carbon	CB4745	01121	1
A2R3	Res, 1000 ohms ±5%, ¼ W, carbon	CB1025	01121	2
A2R4	Res, 510 ohms ±5%, ¼ W, carbon	CB5115	01121	1
A2R5	Res, 1000 ohms, same as A2R3			
A2R6	Res, 4700 ohms ±5%, ¼ W, carbon	CB4725	01121	1
A2R7	Res, 180 ohms ±5%, ¼ W, carbon	CB1815	01121	1
A2R8	Res, var, 5000 ohms ±20%, .5 W	3389W-1-502	80294	2
A2R9	Res, Var, 5000 ohms, same as A2R8			
A2R10	Res, 0.51 ohms ±5%, 2 W, wire wound	Type BWH	75042	1
A2R11	Res, 1200 ohms ±5%, ¼ W, carbon	CB1225	01121	1
A2Y1	Crystal, 1 MHz	7600000210	18410	1

PARTS LIST

REF DES	DESCRIPTION	PART NO.	MFR	QTY/ ASSY
	READOUT ASSEMBLY A3			
A3	Circuit Card Assy composed of the following components, (See figure 4 for component location).	1100001830	18410	1
A3C1	Cap, 1000 uF (-10%, +100%), 15 wvdc electrolytic	28-625-1000 -15T-85	29309	1
A3CR1	Diode, light emitting (Litronix Inc.)	RED-LITE2		2
A3CR2	Diode, same as A3CR1			
A3IC1	Integrated Circuit, numeric display	TIL-302	01295	6
A3IC2	Integrated Circuit, same as A31C1			
A3IC3	Integrated Circuit, same as A3IC1			
A3IC4	Integrated Circuit, same as A3IC1			
A3IC5	Integrated Circuit, same as A3IC1			
A3IC6	Integrated Circuit, same as A3IC1			

PARTS LIST

REF DES	DESCRIPTION	PART NO.	MFR	QTY/ ASSY
	READOUT ASSEMBLY A3 (Cont)			
A3Q1	Transistor, silicon, NPN	2N3704	01295	2
A3Q2	Transistor, silicon, NPN	2N3710	01295	1
A3Q3	Transistor, silicon, PNP	2N3702	01295	1
A3Q4	Transistor, same as A3Q1			
A3R1	Res, 270 ohms ±5%, ¼ W, carbon	CB2715	01121	43
A3R2	Res, 270 ohms, same as A3R1			
A3R3	Res, 270 ohms, same as A3R1			
A3R4	Res, 270 ohms, same as A3R1			
A3R5	Res, 270 ohms, same as A3R1			
A3R6	Res, 270 ohms, same as A3R1			
A3R7	Res, 270 ohms, same as A3R1			
A3R8	Res, 270 ohms, same as A3R1			
A3R9	Res, 270 ohms, same as A3R1			
A3R10	Res, 270 ohms, same as A3R1			
A3R11	Res, 270 ohms, same as A3R1			
A3R12	Res, 270 ohms, same as A3R1			

PARTS LIST

REF DES	DESCRIPTION	PART NO.	MFR	QTY/ ASSY
	READOUT ASSEMBLY A3 (Cont)			
A3R13	Res, 270 ohms, same as A3R1			
A3R14	Res, 270 ohms, same as A3R1			
A3R15	Res, 270 ohms, same as A3R1			
A3R16	Res, 270 ohms, same as A3R1			
A3R17	Res, 270 ohms, same as A3R1			
A3R18	Res, 270 ohms, same as A3R1			
A3R19	Res, 270 ohms, same as A3R1			
A3R20	Res, 270 ohms, same as A3R1			
A3R21	Res, 270 ohms, same as A3R1			
A3R22	Res, 270 ohms, same as A3R1			
A3R23	Res, 270 ohms, same as A3R1			
A3R24	Res, 270 ohms, same as A3R1			
A3R25	Res, 270 ohms, same as A3R1			
A3R26	Res, 270 ohms, same as A3R1			
A3R27	Res, 270 ohms, same as A3R1			
A3R28	Res, 270 ohms, same as A3R1			
A3R29	Res, 270 ohms, same as A3R1			

PARTS LIST

REF DES	DESCRIPTION	PART NO.	MFR	QTY/ ASSY
	READOUT ASSEMBLY A3 (Cont)			
A3R30	Res, 270 ohms, same as A3R1			
A3R31	Res, 270 ohms, same as A3R1			
A3R32	Res, 270 ohms, same as A3R1			
A3R33	Res, 270 ohms, same as A3R1			
A3R34	Res, 270 ohms, same as A3R1			
A3R35	Res, 270 ohms, same as A3R1			
A3R36	Res, 270 ohms, same as A3R1			
A3R37	Res, 270 ohms, same as A3R1			
A3R38	Res, 270 ohms, same as A3R1			
A3R39	Res, 270 ohms, same as A3R1			
A3R40	Res, 270 ohms, same as A3R1			
A3R41	Res, 270 ohms, same as A3R1			
A3R42	Res, 270 ohms, same as A3R1			

PARTS LIST

REF DES	DESCRIPTION	PART NO.	MFR	QTY/ ASSY
	READOUT ASSEMBLY A3 (Cont)			
A3R43	Res, 2700 ohms ±5%, ¼ W, carbon	CB2725	01121	1
A3R44	Res, 270 ohms, same as A3R1			
A3R45	Res, 150 ohms ±5%, ¼ W, carbon	CB1515	01121	2
A3R46	Res, 1000 ohms ±5%, ¼ W, carbon	CB1025	01121	2
A3R47	Res, 1000 ohms, same as A3R46			
A3R48	Res, 49.9 ohms ±1%, ¼ W, metal film	RY57D49R9F	18410	1
A3R49	Res, 510 ohms ±5%, ¼ W, carbon	CB5115	01121	1
A3R50	Res, 750 ohms ±5%, ¼ W, carbon	CB7515	01121	1
A3R51	Res, 150 ohms, same as A3R45			

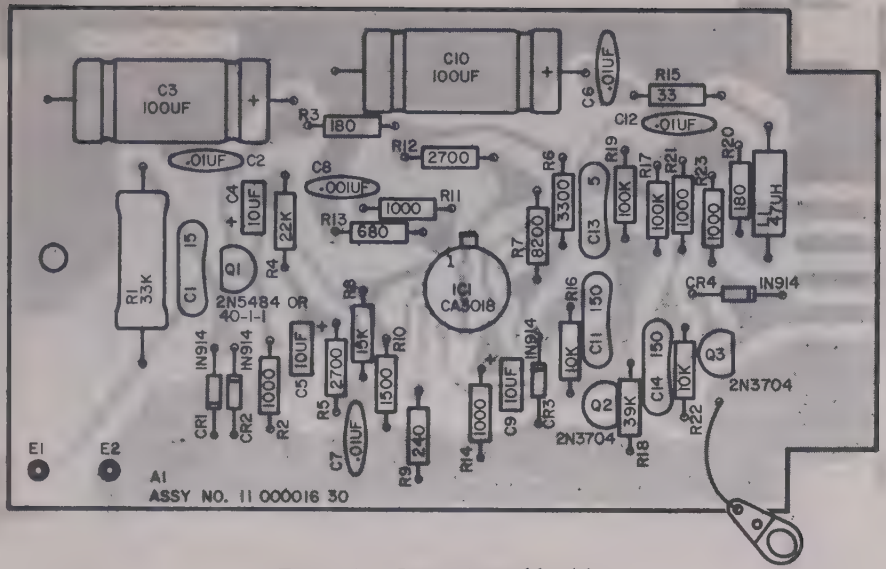


Figure 2. Input Assembly A1

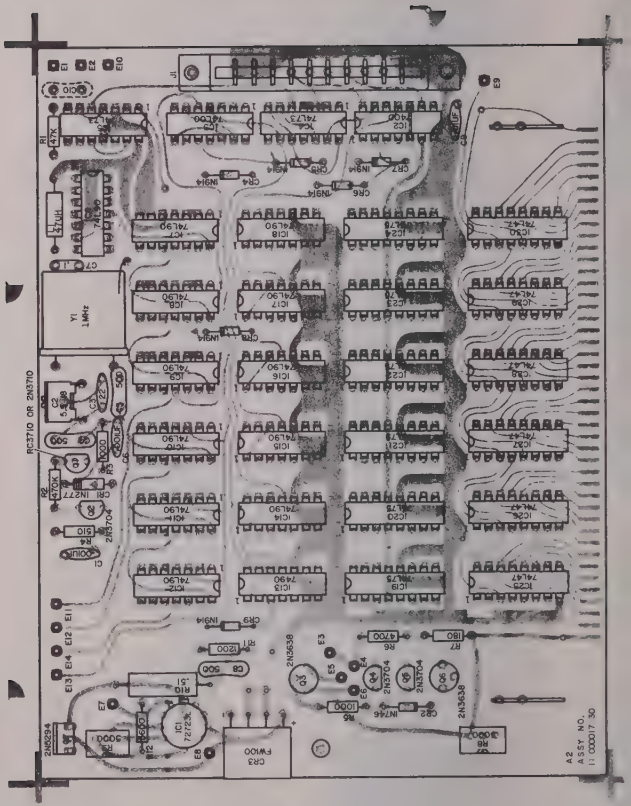


Figure 3. Counter Assembly A2

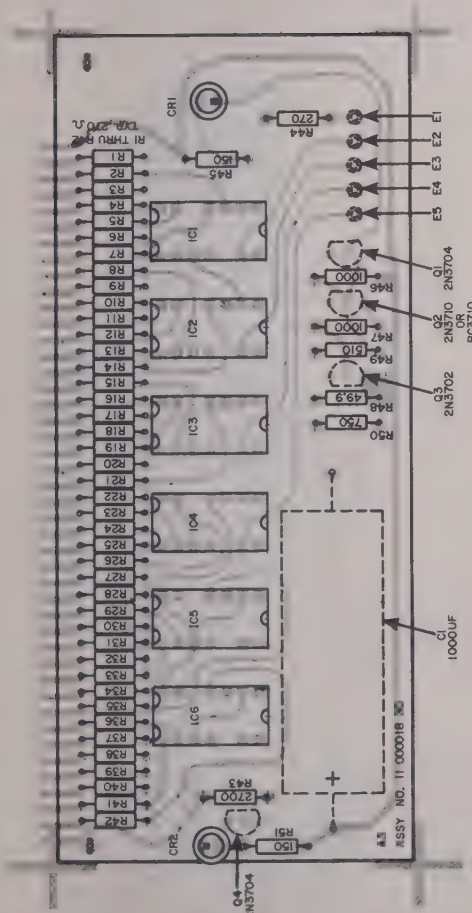


Figure 4. Readout Assembly A3

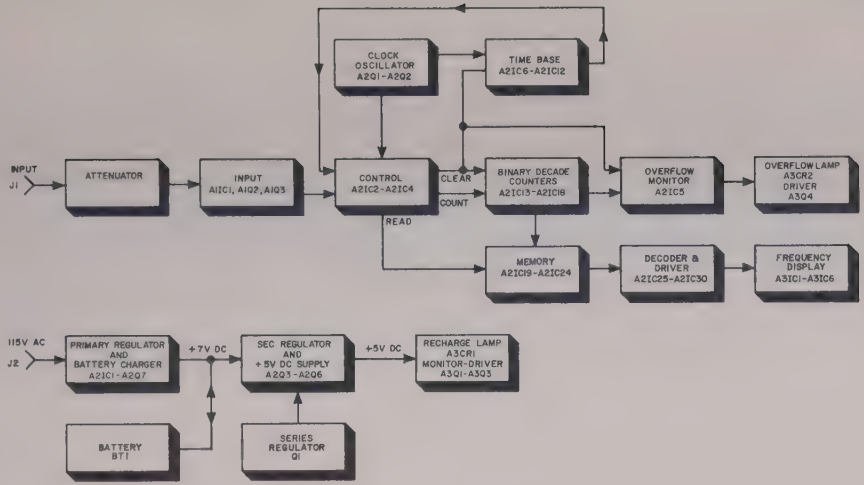
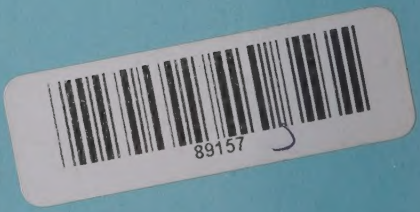


Figure 5. Block Diagram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